

## APPENDIX 1 – SHOREBIRD DATA AUDIT

Author	Attribute sampled	Spatial coverage	Temporal coverage	Method	Data	Status	Format
Gosper, D. (1981)	all known roosts	Richmond Estuary	Monthly from 12/72 to 1/74	high tide surveys of roosts	Population range/site/species	collated	hard copy
Morris, A. K., McGill, A. R., & Holmes, G. (1981)	Summary of bird species and populations in NSW; may contain early population estimates for some sites.					not collated	hard copy
Morris, A. K. (1983)	Identifies priorities for the conservation of waders, gulls and terns in NSW.					not collated	hard copy
Gosper, D. (1983)	rocky shore & ocean beach	2 sites: Flat Rock & Patches Beach	77 censuses– June 77 to December 79	repeated surveys at various tidal stages	population range/site/species	collated	hard copy
Martindale, J. (1984)	all known roosts and foraging areas	Clarence Estuary	30/3 to 12/4 1984	repeated surveys at high tide	maximum counts/roost/species; map of roosts & foraging habitat.	collated	digital
Martindale, J. (1987)	all known roosts and foraging areas	Tweed Estuary	26/1 to 6/2 1987	repeated surveys at high tide	maximum counts/roost/species; foraging densities; map of roosts & foraging habitat.	collated	hard copy
Holmes, G. (1988)	all known roosts; foraging habitat in north creek	Richmond Estuary	3-6/2/1988 & 20/2/88	repeated surveys	maximum counts/roost and foraging site/species	collated	hard copy
Dettmann, B. E. (1989)	2 roosts	Mobbs Bay & South Ballina Beach, Richmond Estuary	9/88 to 3/89	repeated high tide surveys	maximum counts/species for both sites combined.	collated	hard copy
Holmes, G. (1990a)	foraging sites	North Creek area, Richmond Estuary	1/3/90 to 3/3/90	repeated low tide census	Counts/site/day	collated	hard copy
Holmes, G. (1990b)		Tweed Estuary				not available	
Holmes, G. (1991)	roosts and foraging areas	Tweed Estuary	12/12/90 to 2/4/91	repeated high tide surveys & simultaneous surveys on 1-2/2/91.	maximum counts for estuary & site/species.	collated	hard copy
Rohweder, D. (1991)	roosts	Richmond Estuary	9/91 to 11/91	repeated (7) high tide surveys	maximum counts/species/site	collated	hard copy

Author	Attribute sampled	Spatial coverage	Temporal coverage	Method	Data	Status	Format
Smith, P. (1991)	na	Tweed, Richmond, Clarence, Corindi, Bellinger, Nambucca, Macleay, Hastings, Camden Haven	1972-1990; summer/winter surveys 86-89	na	maximum counts/species	collated	hard copy
Holmes, G. (1992)	roost and foraging areas	North Creek area, Richmond Estuary	3/90 to 2/92	12 sample days in 6 months	maximum counts/sample, counts/low tide sample, counts/roost/sample	collated	hard copy
Lawler, W. (1994)	Roosts & selected foraging areas	Tweed (2), Richmond (1), Clarence (1), Wooli (2), Bellinger (1), Macleay (2), Hastings (1)	February 1992, March 1993 & 1994	1 count/day at each estuary	maximum counts/time period, maximum counts/roost & feeding area	collated	hard copy
NRAC (1994)	roost & foraging areas	all estuaries & most ocean beaches between Tweed Heads & Woolgoolga	Oct & Nov 1994	1 count/estuary (or beach) during each time period	simultaneous estimation of roost & feeding areas	collated	digital
WBM Oceanics (1996)	roost & foraging areas	Tweed Estuary	8/95 and 4/96	12 two-day samples at 3 week intervals between	maximum counts/species in study area, maximum & minimum individuals/site at high and low tide, max & min migratory & resident at each site	collated	hard copy
Owner, D. G. (1997)	ocean beaches	Kingscliff to Iluka	May to August 1997	4 samples each over two days	maximum counts of Pied Oystercatcher/beach	collated	digital
Clancy, G. (1992)	roosts	Clarence Estuary	6/91 to 2/92	5 sample days	maximum count/species/site	collated	digital
SES (2003)	roost & foraging areas	Tweed Estuary	3/97 to 2/02	20 samples each 3 days duration	maximum counts/species/site/sample period	collated	digital
Lewis, B. D. (2003)	roosts	Tweed Estuary	February 2003	1 sample period	maximum counts/species/site	collated	digital
SES (2000)	Beach Stone-curlew habitat	15 estuaries, 2 ICOLLs, 4 beaches between Tweed Heads & Camden Haven River	Feb-00	10-22/2/00	location & number of Beach Stone-curlew/site	collated	digital
Sandpiper Environmental (2005)	roosts	Clarence Estuary	10/04 to 6/05	simultaneous estimation at all roosts; 1 sample/month over 7 months	no. individuals/species/site/survey	collated	hard copy

Author	Attribute sampled	Spatial coverage	Temporal coverage	Method	Data	Status	Format
Rohweder, D. (2004)	roost & foraging areas	Bellinger Estuary	7/02 to 3/03	monthly surveys of roosts (1 day each); 1 survey of foraging areas	no. individuals/species/site; maximum counts	collated	digital
SES. (2009)	roosts	Tweed Estuary	2/09	1 day survey of roosts	no. individuals/site	collated	digital
Murphy, M. (2008)	roost & foraging sites	Moonee Creek	3/1996 to 3/1997	27 traverses at low tide	maximum counts	collated	hard copy
Harrison, A. (2009)	rocky shores, ocean beaches and lower reaches of estuaries	South Ballina Beach to Bonville Estuary (Sawtell)	seasonal surveys 2003-2005	population surveys along coastline over consecutive days	max counts, nest sites, breeding success, impacts of disturbance on nesting behaviour of Pied and Sooty Oystercatchers (foraging data also collected but remains as unpub. data)	TBC	TBC
AWSG 1981-2006	roosts	Data available for most major estuaries but Tweed, Richmond & Clarence have best coverage	summer and winter surveys - predominantly in the Tweed, Richmond & Clarence	typically 1 day/time period but methods vary between sites	no. ind/species	collated	digital
NSW WSG (1996-2004)	low & high tide surveys	Most ocean beaches & estuaries in NRCMA Region	Over 2 days in November 96, 98, 00, 02 & 04.	volunteers traversed ocean beaches & some estuaries	no. individuals/species/site	collated 96, 98, 00	digital
DECC (1997-2008)	Pied Oystercatcher nest sites	Beaches & ICOLLs between Black Rocks & South Ballina	July-Nov/Dec 97-08	traverse of beaches in 4WD vehicle & nest inspections	no. Pied Oystercatchers (some surveys), distribution, nest sites, breeding success.	not collated	hard copy
Birds Australia - Shorebirds 2020 (06-09)	roosts	Major estuaries - Tweed, Brunswick, Richmond, Clarence, Nambucca, Hastings & Camden Haven	summer and winter surveys	TBC	TBC	collated	hard copy
Belongil Bird Buddies	roosts	Belongil Estuary	unknown	unknown	unknown	not collated	unknown
Rohweder, D. (unpublished)	roosts	Richmond Estuary	surveys (monthly & weekly) between 7/93	all roosts sampled in one time period	no. individuals/species/site/survey and maximum counts/survey	collated	hard copy

Author	Attribute sampled	Spatial coverage	Temporal coverage	Method	Data	Status	Format
			and 6/97; some weekly surveys in 93/94				
Rohweder, D. (unpublished)	foraging areas	Richmond Estuary	fortnightly between 12/93 and 3/94 & some winter counts in 1994	feeding areas sampled over two days	no. individuals/species/site	collated	hard copy
Rohweder, D. (unpublished)	roosts	Richmond Estuary	surveys between 2/98 and 11/03	all roosts sampled in one time period	no. individuals/species/site	collated	hard copy
Rohweder, D. (unpublished)	roosts	Sandon, Wooli, Nambucca	various partial surveys 2000 to 2003	partial high tide survey of estuary	no. individuals/species/site	collated	hard copy
Rohweder, D. & Totterman, B. (undated)	roosts	Richmond Estuary	monthly between 4/2004 and 3/2005	all roosts sampled in one day	no. individuals/species/site/sample; maximum count/species	collated	digital
Marshall, C. (undated)	roosts	Nambucca Estuary	weekly in Aug/Sept 2000	surveyed small number of roosts	no. individuals/species/site/sample	collated	digital
Rohweder, D. (unpublished)	ICOLL & roost	Salty Lagoon	quarterly 2008 & 2009	2 samples/quarter	maximum count/survey period (quarter)	collated	digital
NSW WSG (undated)	selected roosts	Clarence Estuary	sporadically between 11/93 and 11/01	sporadic surveys of selected roosts	no. individuals/species/site/survey	collated	digital
Clarence Valley Birdo's (2003)	roosts	Clarence Estuary	February 2003	simultaneous estimation	no. individuals/species/site; maximum counts.	collated	digital
Clarence Valley Birdo's (2004)	roosts	Clarence Estuary	February 2004	simultaneous estimation	no. individuals/species/site; maximum counts.	collated	digital
Clancy, G. (unpublished)	roosts	Clarence Estuary - Dart Is to Wooloweyah Ent	20 summer & winter surveys between 2/88	simultaneous estimation	no. individuals/species/site/survey	collated	digital

Author	Attribute sampled	Spatial coverage	Temporal coverage	Method	Data	Status	Format
			and 6/01				
Rohweder, D. (unpublished)	roost & foraging sites	Clarence Estuary - Dart Is to Wooloweyah Ent	7 high tide surveys & 2 low tide surveys between 10/95 and 7/96	simultaneous estimation	no. individuals/species/site/survey	collated	digital
Martindale, J. (undated)	selected roosts	Part of Clarence Estuary	4 surveys between 2/1986 and 6/1987	maximum counts	no. individuals/species/site	collated	digital
Clancy, G. (2002)	roosts	Clarence Estuary	February 2002	simultaneous estimation	no. individuals/species/site; maximum counts.	collated	digital
Browne, N. (undated)	roost	Chickiba Lake - Richmond Estuary	frequent, sometimes daily, survey of major roost between 9/1988 & 2/91	na	no. individuals/species/sample	collated	hard copy

## APPENDIX 2 : Spatial datasets identified during the rapid shorebird data audit

Author	Attribute sampled	Spatial coverage	Temporal coverage	Method	Data	Status	Format
NSW EPA & Dept of Transport (1999)	shorebird habitat	all major estuaries and ocean beach & rocky shores in NRCMA region	na	na	spatial dataset of important shorebird habitat	available	digital
Sandpiper Ecological Surveys (2006)	roost & foraging areas	Clarence Estuary	na	mapped roost & foraging areas	spatial data on roost & foraging habitat & supporting files on shorebird presence & abundance/site	support data available	digital
Avifauna Research and Services (2006)	roost & foraging areas for threatened shorebirds	Tweed, Brunswick, Richmond, Clarence, Hastings	na	mapped important roost & foraging areas	spatial datasets of roosts & feeding areas used by threatened shorebirds	TBC	TBC
Whetham, L & Scanlon, T. (2007)	geographic locations	NR CMA Region	na	used point locality data to identify species and location hotspots for threatened shorebirds	maps of hotspot locations	available	digital
Shorebirds 2020	National Shorebird Areas	shorebird areas to be surveyed regularly as part of the Population Monitoring Program	includes summary population data for each area	Mapped using Auslig 1: 100,000 maps and data sourced from Population Monitoring Program	extent of each important shorebird area in Australia with supporting data.	available	digital

## APPENDIX 3: Example of data linked to spatial mapping undertaken as part of the Shorebird 2020 project

Abbreviations refer to species names, for example BAGO = Bar-tailed Godwit.

Example of data linked to shapefile: Shorebird_count_areas_aust	
Criteria	STATE
STATE	NSW
SBIRD_AREA	Richmond River estuary
COUNT_AREA	Lake Chickiba
CODE	RRE02
HABITAT	
COMMENTS	
SOURCE	Hans Lutter
PERIMETER_	1018.187
HECTARES	5.830
LONGITUDE	153.58436
LATITUDE	-28.84664
TOTAL_RICH	31
MIG_RICH	24
NUMB_VISIT	9
NUMB_YEARS	8
COGR_MAX	48
COGR_AVG	14

Example of data linked to shapefile: Shorebird_areas_aus08sept	
SBIRD_AREA	Richmond River estuary
YEARS_DATA	23.000000
TOTAL_RICH	39.000000
MIG_RICH	30.000000
MAX_AB_ALL	1908.000000
AVG_AB_ALL	862.347826
MAX_AB_MIG	1712.000000
AVG_AB_MIG	799.913043
BAST_MAX	30.000000
BAST_AVG	2.739130
BAGO_MAX	306.000000
BAGO_AVG	148.869565
BLDO_MAX	6.000000
BLDO_AVG	1.173913
BLGO_MAX	65.000000
BLGO_AVG	6.608696
CUSA_MAX	217.000000
CUSA_AVG	69.043478

Example of data linked to roost mapping in the Clarence Estuary	
ID	SITE
COUNT	11
SITE_NAME	Wooloweyah Entrance
MAP_METHO	GPS
SUBSTRATE	Muddy Sand
ROOST_TYP	Neap Tide
NO__TIMES	53
MAX__COUN	1460
TOTAL_SP_	23
NO__THR_S	6
NO__MIG__	17
SPECIES_1	Black-tailed Godwit (258)
SPECIES_2	Bar-tailed Godwit (448)
SPECIES_3	Whimbrel (38)
SPECIES_4	Eastern Curlew (70)
THR_SCORE	37
HAB_SCORE	73
PRIORITY	Medium

## APPENDIX 4 - Prioritisation of threats at 24 high tide roosts in the Clarence Estuary

THREAT CATEGORY / Threat type	Esk Mouth	Woram Channel	Bolorobo Nth	Bol orobo Is	Goodwood Is	Iluka Breakwall	Freeburn Nth	Dart/Hickey Island	Hickey Saltmarsh	The Penn	Rabb Is	Reedy Ck saltmarsh	Sleeper Is	Crystal Waters	Yamba Quays	Micalo North	Prawn Farm	Wooloweyah Entrance	Palmers Is SE	Shark Bay	Back Beach	Woody Head	Frasers Reef	Iluka Bluff
<b>HABITAT LOSS</b>																								
Erosion (existing)	1				5		5	1		1	1	5	5			1			5	5				
Areas being developed - foreshore															20									
Areas proposed for development																5	20							
Development permissible within zone					10		5																	
Aquaculture																	20							
<b>Sub-Total</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>5</b>	<b>0</b>	<b>20</b>	<b>6</b>	<b>40</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>SEA-LEVEL RISE</b>																								
Reduced habitat area & duration of exposure or increased inundation	5		5		20	5	5	1	10	1	1	10	10	1	10	10			10	20	10	10	10	20
Enhanced conditions for mangroves	10		5		10			1	10			10	10			10	10	5	10					
Erosion (predicted)					5		5	10		10	10	10				10			5	5	5			5
<b>Sub-Total</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>35</b>	<b>5</b>	<b>10</b>	<b>12</b>	<b>20</b>	<b>11</b>	<b>11</b>	<b>30</b>	<b>20</b>	<b>1</b>	<b>10</b>	<b>30</b>	<b>10</b>	<b>5</b>	<b>25</b>	<b>25</b>	<b>15</b>	<b>10</b>	<b>15</b>	<b>20</b>
<b>HABITAT MODIFICATION</b>																								
Mangrove encroachment (existing)	5		5		5		1	1		5						10	10	10	5					



THREAT CATEGORY / Threat type	Esk Mouth	Woram Channel	Bolorobo Nth	Bol orobo Is	Goodwood Is	Iluka Breakwall	Freeburn Nth	Dart/Hickey Island	Hickey Saltmarsh	The Penn	Rabb Is	Reedy Ck saltmarsh	Sleeper Is	Crystal Waters	Yamba Quays	Micato North	Prawn Farm	Wooloweyah Entrance	Palmers Is SE	Shark Bay	Back Beach	Woody Head	Frasers Reef	Iluka Bluff
Grazing					5		1						5			5								
Artificial lighting						1		1	1	1	1	1		1	5									
Altered drainage/drains													1	10	10	10								
<b>Sub-Total</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>10</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>6</b>	<b>1</b>	<b>15</b>	<b>25</b>	<b>20</b>	<b>10</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>HABITAT DISTURBANCE (PROXIMITY)</b>																								
Commercial fishing site	5	5	5	5	5	5	1	5		5	5	1	5	5	5	5	1	5	1	5	1	1	1	1
Popular rec fishing site	1	1	1	1	5	5	10	10		10	10	1	5	5	5	5	1	5	1	10	10	10	5	10
Bait collecting site					1		5	10		10	10		1	5	1			5		5	5	5	5	5
Dog exercise area			1					10	10	10				1	5									
Walking/swimming area			1		1	5	1	10	10	10	1	1		1	1					10	10	10	10	10
Sailing boat route					1	1	1																	
Jetski/waterski/kite surf					1			1																
Main boating channel	1		5		5	5	5	5		5	5	1	5	5	5	5	1	1	5			5		
4WD vehicles								10												5				
Major road						1		1						1	1									
<b>Sub-Total</b>	<b>7</b>	<b>6</b>	<b>13</b>	<b>6</b>	<b>19</b>	<b>22</b>	<b>23</b>	<b>62</b>	<b>20</b>	<b>50</b>	<b>31</b>	<b>4</b>	<b>16</b>	<b>23</b>	<b>23</b>	<b>15</b>	<b>3</b>	<b>16</b>	<b>7</b>	<b>35</b>	<b>26</b>	<b>31</b>	<b>21</b>	<b>26</b>
<b>MORTALITY</b>																								
Introduced pests (predicted)					5	5		10	5	5		5	5		5	5	5	5	5	5	5	5	5	5
Kleptoparasites					5	5		5		5	5									5	5	5	5	5
4WD vehicles								10												1				
<b>Sub-Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>10</b>	<b>0</b>	<b>25</b>	<b>5</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>11</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>
<b>HABITAT DISTURBANCE</b>																								

THREAT CATEGORY / Threat type	Esk Mouth	Woram Channel	Bolorobo Nth	Bol orobo Is	Goodwood Is	Iluka Breakwall	Freeburn Nth	Dart/Hickey Island	Hickey Saltmarsh	The Penn	Rabb Is	Reedy Ck saltmarsh	Sleeper Is	Crystal Waters	Yamba Quays	Micato North	Prawn Farm	Wooloweyah Entrance	Palmers Is SE	Shark Bay	Back Beach	Woody Head	Frasers Reef	Iluka Bluff
<b>(SOURCES)</b>																								
Formal boat ramp			1		1	5	1	1	1					1	5	1					1	5		
Marina/mooring site						1	1	1	1	1	1	1		5	5									
Formal picnic site			1			1		1	1				1	5	1					1	1	5		5
Informal picnic site							10	10	1	10	10					5				5	5	10	1	5
Boat hire						1	1	1	1															
Camp/caravan park			1		1	1	1	1	1												1	5		
Tourist facility (hotel/motel/restaurant)						1	1	1	1	1	1	1												
4WD beach entrance																				1				
Developed areas (urban) foreshore					1	1	1	1	1	5	1	5	1	5	1									
<b>Sub-Total</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>11</b>	<b>16</b>	<b>17</b>	<b>8</b>	<b>17</b>	<b>13</b>	<b>7</b>	<b>2</b>	<b>16</b>	<b>12</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>8</b>	<b>25</b>	<b>1</b>	<b>10</b>
<b>POLLUTION SOURCES</b>																								
High risk acid sulphate soil	10	5	5	5	10	1	1	1	1	1	1	10	10	1	1	10	10	1	10					
Sugar Cane																			1					
<b>Sub-Total</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>10</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>10</b>	<b>10</b>	<b>1</b>	<b>1</b>	<b>10</b>	<b>10</b>	<b>1</b>	<b>11</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>TOTAL</b>	<b>38</b>	<b>11</b>	<b>36</b>	<b>11</b>	<b>102</b>	<b>50</b>	<b>62</b>	<b>120</b>	<b>55</b>	<b>96</b>	<b>63</b>	<b>62</b>	<b>64</b>	<b>42</b>	<b>86</b>	<b>97</b>	<b>88</b>	<b>37</b>	<b>58</b>	<b>83</b>	<b>59</b>	<b>76</b>	<b>47</b>	<b>66</b>